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Net Worth of the Household Sector, 1970 to 2012: A Canada–United States Comparison

by Amélie Lafrance and Ryan Macdonald

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...	not applicable
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0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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Amélie Lafrance and Ryan Macdonald
Economic Analysis Division, Statistics Canada

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Abstract

This report uses three approaches to examine trends in household net worth per capita in Canada and the United States from 1970 through 2012. First, a purchasing-power-parity-based comparison shows that household net worth per capita in Canada and the United States increased at a similar rate through most of the period. However, differences emerged with the 1973 oil shock and with the collapse of the U.S. housing market in 2007.

Household net worth per capita growth is then examined relative to consumption prices and to disposable income. The behaviour of both measures was similar in Canada and the United States, but the timing of trend changes and the magnitude of cyclical movements differed. The rate of increase in net worth accelerated in both nations in the 1990s, but the change occurred first in Canada. This more rapid growth continued in Canada after the late-2000s recession, but in the United States, the growth rate returned to values closer to the 1974-to-1996 period. In both nations, the amplitude of net worth changes across business cycles increased, although the effect was more pronounced in the United States.

Finally, a decomposition of net worth relative to disposable income shows the sources of change over time. Changes in financial assets rather than in debt or non-financial assets tended to be the main source of year-to-year fluctuations in net worth. The major exception was the negative contribution of non-financial assets to net worth growth in the United States that occurred in the latter half of the 2000s, when the U.S. housing market collapsed.

Executive summary

This report compares household net worth per capita in Canada and the United States from 1970 to 2012, using data from the Canadian National Balance Sheet Accounts and the Flow of Funds Accounts published by the U.S. Federal Reserve.

Three approaches are adopted. The first makes a level comparison using values adjusted for purchasing power parity (PPP). The second uses ratios of real net worth per capita and net worth relative to disposable income. The third decomposes the growth of the ratio of net worth to disposable income. Together, these approaches provide mutually re-enforcing results that are more robust than what could be derived from any one approach in isolation.

The analysis shows that between 1975 and 2006, Canadian net worth per capita averaged 60% of PPP-adjusted U.S. net worth. The collapse of the U.S. housing market and subsequent recession reduced net worth per capita in the United States from CAN$ 271,500 in 2007 to CAN$ 224,000 in 2008. At the same time, Canadian net worth per capita declined by substantially less, from CAN$ 177,500 to CAN$ 164,900. As a result, Canadian net worth per capita rose to 74% of the U.S. level in 2008, and continued to rise, reaching 77% in 2009, a level maintained until the end of the study period in 2012.

Home values are particularly important for relative net worth per capita growth. Throughout the 1970-to-2012 period, changes in overall relative net worth per capita were correlated with the relative per capita value of Canadian and U.S. housing assets.

Inflation-adjusted real net worth per capita and the ratio of net worth to disposable income both indicate that household net worth generally increased at a similar rate in Canada and the United States. The exceptions were the 1973 oil shock and the end of the period covering the collapse of the U.S. housing market in 2007.

Inflation-adjusted real net worth per capita and the ratio of net worth to disposable income point to a greater variance across business cycles and a structural break in the trend of the rate of increase of net worth in both nations in the 1990s. The increase in cyclical amplitude was larger in the United States. The trend change occurred first in Canada and continued until the end of the period; in the United States, a trend similar to that present prior to the 1990s emerged.

Changes in financial assets were the major contributors to changes in net worth in both countries. However, during the U.S. housing market collapse, the United States had a substantial negative contribution from declining home values (non-financial assets), which did not occur in Canada. In neither country was debt a major source of year-to-year fluctuations in net worth.

1 Introduction

The collapse of the U.S. housing market beginning in 2007 brought renewed attention to the role of debt in economic performance. Credit surges (Tang and Upper 2010) and rising leverage (Mian and Sufi 2009) are important signs of possible debt problems. Moreover, the effects of debt crises can resonate for years (Dyan 2012; Furceri and Zdzienicka 2012).

The U.S. housing market collapse also focused attention on household balance sheets (Cooper and Guatieri 2012; Credit Suisse 2012; Dyan 2012; Glick and Lansing 2009; Mian and Sufi 2009), and specifically, how the Canadian household balance sheet, notably, liabilities (Bailliu, Kartashovak and Meh 2012) compare with those of the United States.

A number of international comparisons of household net worth have included Canada and the United States. Antoniewicz et al. (2005) studied differences between wealth data in Canada, the United States and Italy. Similarly, a Credit Suisse (2012) multi-national analysis[1] included Canada and used a market exchange rate to convert Canadian dollars into U.S. dollars. While this may be applicable in some circumstances,[2] it is not ideal for examining which country's net worth translates into a higher level of material well-being on average (See for example: *Review of the OECD-Eurostat PPP Program*). Importantly, these analyses did not examine net worth in Canada and the United States over longer periods of time.

This report focuses on Canadian and U.S. household net worth per capita from 1970 through 2012, using data from the Canadian National Balance Sheet Accounts and the Flow of Funds Accounts published by the U.S. Federal Reserve. It contributes to knowledge about net worth comparisons by providing information about the evolution of Canadian versus U.S. net worth over four decades.

Three methods for examining net worth are employed. The first is a level comparison using values adjusted for purchasing power parity (PPP). The second uses ratios for real net worth per capita and net worth relative to disposable income. The third decomposes the growth of the ratio of net worth to disposable income. Together, the three approaches allow for a more robust analysis than could be derived from any one of them alone.

In the next section, the data and concepts are explained. Sections 3 and 4 examine the growth of net worth in Canada and the United States from different perspectives. Section 5 concludes.

2 Data and concepts

This study employs three key concepts. First, households are the unit of analysis. Second, net worth rather than income is used as the basis for international comparisons. Third, purchasing power parity (PPP) is used to convert between Canadian and U.S. currencies.

Statistics Canada and the U.S. Federal Reserve divide the economy into sectors to facilitate data compilation and analysis. Five broad sectors are defined: the household sector, non-profit institutions serving the household sector (NPISH), the corporate sector, the government sector, and the non-resident sector.

1. This type of household-based analysis, which focuses on metrics other than real gross domestic product, was advocated by the Stiglitz-Sen-Fitoussi (2009) Commission as part of an effort to broaden the range of measures used to assess living standards and economic well-being.
2. The Credit Suisse report's background methodology notes that purchasing power parities (PPPs) are preferable in most cases, but argues that high-net-worth individuals, who comprise a significant share of net worth in some countries, are essentially internationally focussed, so the use of a market exchange rate is appropriate.

To present aggregates as comparable as possible, a combination of the household, unincorporated, and NPISH sectors is used in the analysis. This combination is the lowest level of aggregation for which a comparable concept based on published data for the 1970-to-2012 period is available.

Although Canada and the United States use similar terminology, the units included in each sector can differ. In particular, the treatment of unincorporated businesses differs. Unincorporated businesses are often self-employed individuals, and the way that they report their incomes and assets/debts differs from that of corporations. In the Canadian System of National Accounts (CSNA), the income of the self-employed is referred to as "mixed income" (it contains both labour income and gross operating surplus—the payment in the System of National Accounts [SNA] to capital), and their assets and liabilities are generally understood to include those of their business and those of their household. To be consistent with the way the income flows are calculated, the balance sheet accounts in Canada report unincorporated business assets and liabilities in the household sector.

The U.S. Flow of Funds Accounts reports a separate table for unincorporated non-financial businesses. The net worth of the unincorporated business sector is recorded on the household sector balance sheet, under "proprietor's equity in non-corporate business."[3] To make the Canadian and U.S. data as comparable as possible, the category "proprietor's equity in non-corporate business" is replaced using the table for unincorporated non-financial businesses by allocating their portion of proprietor's equity in non-corporate business to the appropriate household sector asset and liability categories. The remaining portion, which is small relative to household net worth, is included under "other financial assets."

A second difference is the way NPISH are treated. The current practice in Canada is to produce a separate sector account for NPISH, whereas in the United States and in the historical vintages of Canadian data used in this paper, NPISH are included in the household sector. To make the modern Canadian data comparable with the U.S. data and the past vintages of Canadian data, the NPISH sector in Canada is combined with the household sector.

Thus, for both countries, the area of the economy examined consists of households, unincorporated businesses and NPISH. The composition of the units can vary substantially. The populations of unincorporated businesses in the United States and Canada do not exactly correspond (Baldwin, Leung and Rispoli 2011). Unincorporated businesses in the United States earn more income than do those in Canada, and are consequently expected to contain higher asset and debt levels. The balance sheet of the NPISH sector in the United States can include organizations such as hospitals run by religious organizations, of which there are few Canadian equivalents. Where possible, these differences are recorded in residual categories referred to as "other." Analysis and discussion focus on areas most identifiable as belonging to individuals, such as mortgages, residential buildings or pension assets.

This study examines a measure of household wealth referred to as net worth.[4] In the SNA, net worth is a stock-based measure of economic resources that captures the value of financial and non-financial assets, net of liabilities, for each sector and for the economy as a whole.

The net worth estimates employed here are the official estimates from the Federal Reserve and Statistics Canada. Adjustments were made to produce a comparable household sector. Nevertheless, some differences between the two countries' estimation methodologies were not accounted for.

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3. The difference between the net worth of unincorporated non-financial businesses and proprietor's equity in non-corporate business is the value of equity in non-corporate security brokers and dealers.
4. Although the household sector includes unincorporated enterprises, it is referred to as simply the "household sector" throughout the paper.

For this analysis, differences in methodology for pension assets are particularly important. The Federal Reserve accounting method allocates contractual pension obligations to households. This differs from Canada's treatment, which corresponds to the assets held in pension plans.

U.S. data are from the 2012 Flow of Funds Accounts, which contain consistent official estimates for the period covered. The Canadian data were revised in 2012, and the new vintage extends back to 1990. To lengthen the time series, the revised estimates were back-cast to 1970 using the previous data vintage (Appendix). Because of changes in methodology and data sources, estimates from the previous vintage are not entirely comparable with modern estimates. The back-casting incorporates information from aggregate net worth estimates and disaggregate components of net worth. This makes aggregate data more comparable through time than are sub-aggregate categories. However, there is less consistency across data vintages for particular sub-aggregate components.

Net worth represents the cumulative value of household saving and investment activities. Saving is the diversion of current income from consumption; this means that principal debt re-payment is a form of saving. Economic theories (Modigliani and Brumberg 1954; Samuelson 1958) and models (for example, Horner 2009) based on consumer lifecycles predict that individuals raise their net worth during their working lives and reduce their net worth in retirement to support consumption. A stable, predictable path for net worth over time reduces households' planning and risk mitigation costs. The growth of net worth, therefore, is an indicator of the economic environment in which households conduct their financial planning.

Because the CSNA and Flow of Funds Accounts data combine the young and old, they do not match the variables in lifecycle models. Nonetheless, these data should reflect the aging of Canadian and U.S. populations. In particular, the baby boom cohort is expected to have an effect, because the study spans the years when they entered the labour market and the years when the oldest among them began to retire. Boomers constitute a large segment of the population, so as they increased their net worth through saving or capital gains, the net worth of their households might also be expected to increase.

A bilateral Canadian-U.S. PPP is used to convert net worth estimates to a common numeraire. Following Baldwin and Macdonald (2009), PPP rates appropriate for examining international differences in household material well-being are applied to the estimates of U.S. net worth. The PPPs indicate what one dollar will buy in each country, and thereby enable cross-country comparisons of the potential purchases each nation could make on a per capita basis from its net worth.[5]

The PPP employed here is a conversion factor derived from consumer expenditure prices.[6] It is calculated as a weighted average of price ratios for similar products in the two countries, and is taken from data published through Statistics Canada's bilateral PPP program. Official PPP data extend back to 1992; the ratio of Canadian-to-U.S. consumption price deflators is used to back-cast the PPP from 1992 to 1970.

The PPP does not correspond to the relative price of physical and financial assets in Canada and the United States. Rather, it reflects the relative volume of consumer goods and services that could be purchased, assuming that all assets are liquidated at current market prices, all debts are repaid, and the balance is spent on consumption goods and services in the current

5. PPP rates are typically applied to flows rather than stocks. However, for this international comparison, PPP rates are considered to be a more appropriate conversion measure than the market exchange rate.
6. The household final consumption expenditure PPP includes public and private health care expenditures, and so accounts for differences between health care provision between Canada and the United States. The consumption-price-based deflator projects allow for price movements in private markets for health care to affect the price level differentially between Canada and the United States based on the structure of their respective health care markets.

period. These stringent assumptions are unlikely to be met in reality, but they permit a discussion of relative well-being between Canada and the United States, based on each nation's accumulated net worth.

3 Net worth per capita, inter-country measures

The examination of net worth per capita in Canada and the United States starts with estimates of household net worth per capita adjusted for purchasing power parity (PPP), disaggregated by type of asset or debt incurred. Net worth per capita is defined as the sum of financial assets (FA) and non-financial assets (NFA), net of the value of liabilities (LIA), divided by population (Pop). For the United States and Canada, net worth per capita is denoted by lowercase letters:

$$nw_{i,t} = \frac{P_{i,t}^{NW} Q_{i,t}^{NW}}{Pop_{i,t}} = \frac{P_{i,t}^{NFA} Q_{i,t}^{NFA} + P_{i,t}^{FA} Q_{i,t}^{FA} - P_{i,t}^{LIA} Q_{i,t}^{LIA}}{Pop_{i,t}} \quad i = Can, US. \tag{1}$$

The prices and quantities for net worth are defined implicitly in the same way that value-added deflators are defined.

The PPP is defined as the Canadian consumption price level relative to that of the U.S.:

$$PPP_t^{Can/US} = \frac{P_{Can,t}^{PCE}}{P_{US,t}^{PCE}}. \tag{2}$$

U.S. net worth per capita is converted into Canadian dollars by multiplying the U.S. value by the PPP:

$$\begin{aligned} nw_{US,t}^{CAN\$} &= PPP_t \times \frac{P_{US,t}^{NW} Q_{US,t}^{NW}}{Pop_{i,t}} \\ &= \frac{\frac{P_{Can,t}^{PCE}}{P_{US,t}^{PCE}} \times P_{US,t}^{NW} Q_{US,t}^{NW}}{Pop_{i,t}} \\ &= \frac{P_{Can,t}^{PCE} \times \frac{P_{US,t}^{NW}}{P_{US,t}^{PCE}} Q_{US,t}^{NW}}{Pop_{i,t}}. \end{aligned} \tag{3}$$

The advantage of using a PPP is that levels can be compared. But to make comparisons using PPPs, additional assumptions about price behaviour are necessary. These assumptions are more important for an analysis over time than for a single year. For a single year, it is sufficient to assume that per capita net worth is liquidated and used to purchase goods and services today. This is equivalent to assuming $P_{i,t}^{PCE} = P_{i,t}^{NW}$ $i = Can, US$, and facilitates comparisons of relative material well-being.

3.1 Canadian versus U.S. net worth per capita adjusted for purchasing power parity, 2012

Table 1 presents a 2012 breakdown of the Canadian and U.S. household balance sheets for selected items on a per capita basis. The Canadian estimates are also expressed as a ratio of the U.S. estimates, which were converted to Canadian dollars using the PPP rates. Per capita household disposable income is also included because income measures are more commonly converted using PPPs. The balance sheet items are distributed across non-financial assets (tangible assets), financial assets, and liabilities. Non-financial assets consist of residential and non-residential structures and land (collectively termed "real estate"), consumer durable goods such as automobiles, and an "other" category containing assets that tend to belong to unincorporated businesses or for which direct comparisons between Canada and the United States are less reliable. Financial assets include deposits, credit market instruments (for example, bonds, short-term paper and mortgages), stocks, and life insurance and pension plans, and an "other" category. Liabilities comprise credit market instruments (for example, consumer credit, mortgages and loans) and an "other" category that includes liabilities such as trade payables.

In 2012, net worth per capita in Canada was 77% of that in the United States. Per capita disposable income in Canada was 66% of the U.S. level; total assets, 75%; and liabilities, 69%.

Canadian per capita non-financial asset values were 89% of U.S values. Per capita real estate assets (the largest non-financial asset category) in Canada were 94% of the U.S. value. For the next largest category, consumer durables, Canadian values per capita were 83% of U.S. values.

Table 1
Per capita household net worth, assets and liabilities, Canada and the United States, selected items, 2012

	United States		Canada	Canada/ United States
	US$ per capita	CAN$ per capita	CAN$ per capita	ratio (PPP-adjusted)
Total assets	287,500	340,500	255,800	0.75
Non-financial assets	111,900	132,600	117,800	0.89
Real estate	91,200	108,100	101,800	0.94
Consumer durables	15,400	18,300	15,100	0.83
Other	5,300	6,200	900	0.15
Financial assets	175,500	207,900	138,100	0.66
Currency and deposits	32,100	38,000	34,500	0.91
Bonds	18,200	21,600	2,600	0.12
Shares	50,000	59,200	49,300	0.83
Life insurance and pensions	61,300	72,600	47,200	0.65
Other	14,000	16,600	4,500	0.27
Liabilities	61,800	73,200	50,500	0.69
Consumer credit	9,300	11,000	7,600	0.69
Loans	5,400	6,400	3,400	0.53
Mortgages	39,500	46,700	37,900	0.81
Other	7,600	9,000	1,600	0.18
Net worth	225,700	267,300	205,400	0.77
Personal disposable income	39,000	46,200	30,700	0.66
		millions		ratio (population)
Population	314	314	35	0.11

Notes: PPP stands for purchasing power parity. Authors' calculations. U.S. Figures converted to comparable Canadian values using PPP estimates.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

In both countries, financial assets exceeded non-financial assets. Canadian per capita financial asset values were 66% of U.S. values. The relative Canadian values of the asset subcategories currency and deposits (91%), shares (83%) and life insurance and pensions (65%) surpassed the relative value of Canadian assets overall; the Canadian values of the subasset categories bonds (12%) and "other" (27%) were far lower. This may reflect a preference for bonds by U.S. households, or differences between the two countries in the units related to non-profit organizations or non-corporate businesses that are classified in the household category.

Household liabilities per capita in Canada were 69% of those in the United States in 2012. Mortgages, which include lines of credit, were the largest liability in each country.[7] The PPP-adjusted mortgage values in Canada were 81% of the level in the United States.

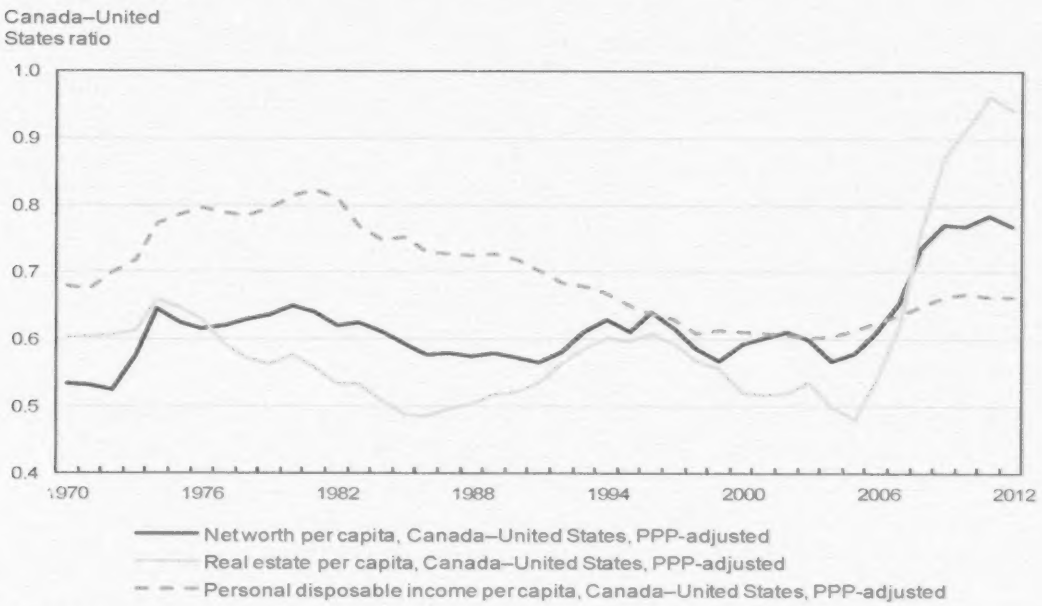
7. The national balance sheet for Canada includes home equity lines of credit in its measure of consumer credit, while the U.S. Flow of Funds Accounts include home equity lines of credit in its mortgage component. To make the treatment more consistent, the Bank of Canada's data on lines of credit are used to adjust consumer credit down and mortgage credit up in Canada.

3.2 Canadian versus U.S. net worth per capita adjusted for purchasing power parity, 1970 to 2012

Table 1 provides a snapshot for 2012, shortly after a sharp downturn in U.S. housing prices. A longer time frame puts 2012 in context. In this case, the ratio of the value of Canadian household net worth per capita to the value of U.S. net worth per capita in Canadian dollars is reported:

$$z_t = \frac{P_{Can,t}Q_{Can,t} \Big/ Pop_{Can,t}}{PPP_t^{Can/US} \times P_{US,t}Q_{US,t} \Big/ Pop_{US,t}} \qquad (4)$$

Chart 1
PPP-adjusted per capita household net worth, real estate assets and disposable income, Canada relative to the United States, 1970 to 2012



Notes: PPP stands for purchasing power parity. Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

Over the 1970-to-2012 period, net worth per capita in Canada ranged from 52% to 78% of the U.S. figure (Chart 1). Coinciding with the first oil shock, the ratio increased sharply from 52% in 1972 to 65% in 1974, and fluctuated around 60% until the 2007-to-2009 U.S. recession. At that point, Canadian net worth per capita rose to 77% of the U.S. level where it remained to the end of the study period.

3.2.1 Detailed balance sheet through time

The relative values of specific balance sheet items should reflect changes in the financial systems in the two countries—for example, changes in mortgage structures, pension foreign content limits, development of the registered retirement savings plan (RRSP) market, and increasing use of mutual funds in Canada; and changes in tax codes and the move to 401K

retirement plans in the United States. However, while these developments likely had important implications for trends in the contribution of particular components to household net worth, the aggregate data in Chart 1 illustrate that the events that had the greatest impact on relative net worth in Canada to the United States were the 1973 oil shock and the collapse of the U.S. housing market.[8]

The path of Canadian relative to U.S. non-financial assets parallels that of relative net worth, but with greater volatility. The relative value of Canadian non-financial assets rose through the early 1970s, and then decreased. Relative values in the 1980s and 1990s averaged 56% and 59%, respectively, but fell below average in recessions. This pattern continued until the U.S. housing market collapsed, and the relative value of Canadian non-financial assets rose.

The relative value of Canadian financial assets also rose from 42% of the U.S. level in 1970 to 66% by 1980. The 1980s saw a small decrease, while the 1990s had a flat trajectory. After 2000, the relative value of Canadian financial assets increased from 59% of the U.S. level in 2000 to 66% in 2012.

Table 2
PPP-adjusted per capita household net worth, assets and liabilities, Canada relative to the United States, selected items and selected years, 1970 to 2012

	1970	1975	1980	1985	1990	1995	2000	2005	2012
	ratio (PPP-adjusted)								
Total assets	0.52	0.61	0.63	0.56	0.57	0.60	0.57	0.56	0.75
Non-financial assets	0.64	0.67	0.62	0.53	0.55	0.61	0.54	0.51	0.89
Real estate	0.60	0.65	0.58	0.49	0.52	0.60	0.52	0.48	0.94
Consumer durables	0.89	0.93	0.95	0.84	0.79	0.78	0.77	0.79	0.83
Other	0.44	0.38	0.38	0.30	0.24	0.26	0.25	0.18	0.15
Financial assets	0.42	0.53	0.66	0.61	0.59	0.59	0.60	0.61	0.66
Currency and deposits	0.87	0.90	1.01	0.72	0.80	0.95	0.83	0.78	0.91
Bonds	0.42	0.57	0.56	0.58	0.36	0.35	0.37	0.18	0.12
Shares	0.14	0.25	0.36	0.41	0.31	0.34	0.50	0.66	0.83
Life insurance and pensions	0.31	0.34	0.50	0.56	0.60	0.61	0.66	0.64	0.65
Other	0.74	0.89	1.25	1.17	1.02	1.25	0.47	0.42	0.27
Liabilities	0.47	0.52	0.56	0.44	0.55	0.54	0.49	0.47	0.69
Consumer credit	0.33	0.52	0.74	0.60	0.79	0.64	0.66	0.66	0.69
Loans	1.03	0.79	0.63	0.46	0.56	0.51	0.55	0.50	0.53
Morgages	0.33	0.43	0.51	0.42	0.50	0.55	0.50	0.47	0.81
Other	1.47	0.71	0.44	0.23	0.37	0.26	0.16	0.15	0.18
Net worth	0.53	0.62	0.65	0.59	0.57	0.61	0.59	0.58	0.77
Personal disposable income	0.68	0.79	0.81	0.75	0.72	0.65	0.61	0.61	0.66
				ratio (population)					
Population	0.10	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11

Notes: Estimates prior to 1990 based on linked series. PPP stands for purchasing power parity. Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

Over the 1970-to-2012 period, the composition of household financial assets changed. Bond holdings became relatively smaller in Canada, while relative stock holdings fluctuated with business cycles around a flat trajectory. Canada's relative holdings of life insurance and pension assets tended to rise.

8. U.S. nominal (not PPP-adjusted) net worth per capita follows the same trend as PPP-adjusted U.S. net worth per capita. In other words, the events cited had a greater impact on net worth than on the PPP index.

From 1970 to 2006, Canadian households' liabilities averaged 50% of U.S. liabilities. After the 1973 oil shock, Canadian liabilities rose above 50% of the U.S. value, and remained there until 1982. By 1985, Canada's liabilities had fallen to 44% of the U.S. value, rose to 56% in 1992, and then declined to 46% in 2004. After the collapse of the U.S. housing market, Canadian liabilities rose, reaching 69% of the U.S. level in 2012, as U.S. households paid down mortgage debt and Canadian households continued to acquire it.

The extent of compositional change in household balance sheets can be illustrated by a dissimilarity index, which shows the percentage of net worth that would have to be re-allocated across financial assets, non-financial assets and liabilities to achieve the same distribution at time t as at time $t-j$:

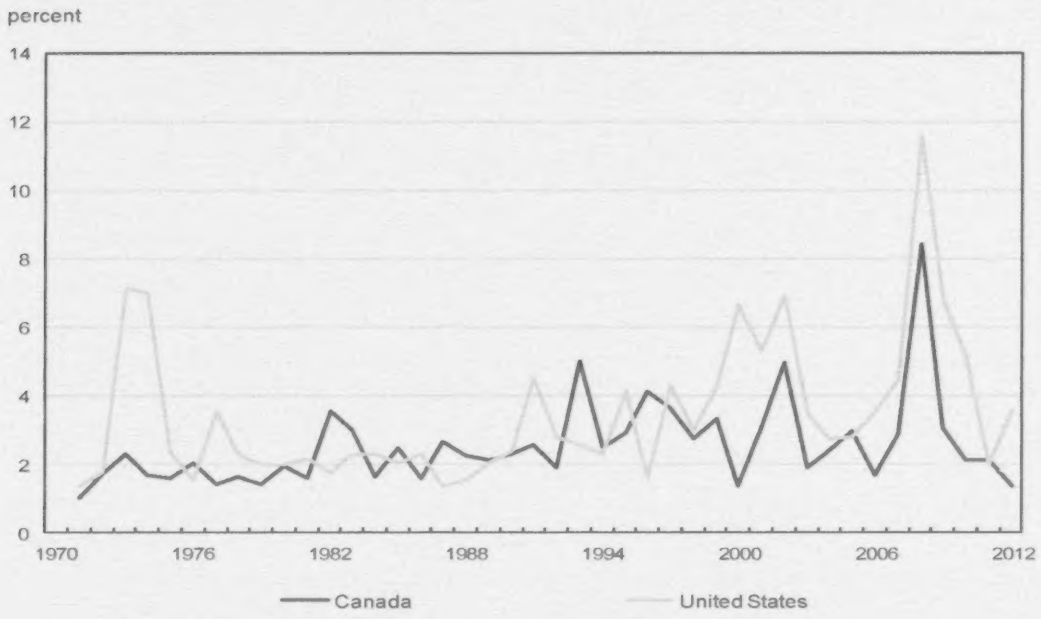
$$DI_t = \frac{\sum_i |\Delta s_i|}{2} \quad i = assets, liabilities. \tag{5}$$

In the formula, s_i is the absolute value of the change in the ratio of assets or liabilities to net worth.

The indexes for Canada and the United States based on data in their respective currencies, show rising compositional change in U.S. net worth over time (Chart 2). Changes were particularly large in specific years: 1973 and 1974, 1991, 2000 through 2002, and 2008. The index for Canada also displays compositional changes in particular years, but they are smaller and less numerous.

Periods of high compositional change do not mean that households are shifting assets around on their balance sheets. Rather, when stock prices or housing prices change rapidly, the composition of assets and liabilities on the balance sheet changes. As a result, households face rising uncertainty about what the value of their net worth will be in any given period. This uncertainty translates into greater difficulties for household consumption smoothing as it becomes more difficult to plan for events such as retirement.

Chart 2
Percentage re-allocation of composition of household net worth per capita, Canada and the United States, 1970 to 2012



Note: Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

3.2.2 Relative importance of non-financial assets

Over the 1970-to-2012 period, the net worth ratio changed when asset prices in the two countries diverged. Although debt is important in financing asset purchases, notably housing, its price is relatively fixed once it is acquired. Asset prices, on the other hand, fluctuate with business cycles and other factors. Consequently, asset prices are the major source of fluctuations in relative net worth per capita.

This is difficult to demonstrate empirically because price indexes for net worth do not exist. In this analysis, instrumental variables that should reflect broad changes in the three major household balance sheet components are used to illustrate the importance of relative asset price changes. For each of the three major components—financial assets (FA), non-financial assets (NFA) and liabilities (LIA)—an instrumental variable for the price is selected based on a heavily weighted subcomponent. That price is used to deflate the nominal FA, NFA and LIA series to produce pseudo quantity indexes. Correlations between the relative prices or relative quantities and changes in relative net worth per capita are reported.

Financial asset prices are approximated by stock price indexes: the Dow Jones Industrial Average for the United States and the Toronto Stock Exchange (TSE) 300 Index for Canada.

National Accounts residential gross fixed capital formation price indexes are used for non-financial asset prices. (Ideally, house price indexes would be used, but the data for the two countries are not fully comparable over the span of the paper) For the United States, the residential investment price index is from the Bureau of Economic Analysis National Income and

Product Accounts. For Canada, the residential investment price index is from Statistics Canada's Canadian System of National Accounts (CSNA).[9]

Liability prices are based on the average chartered bank conventional 5-year mortgage rate for Canada and the 30-year mortgage rate for the United States.[10] While not perfectly comparable, they represent the interest rates that mortgage consumers in each country pay, and their annual changes should reflect changes in mortgage borrowing rates.[11]

Correlations between changes in relative net worth per capita, relative prices per capita, and relative quantities per capita are reported in Table 3. For the 1973-to-2012 period, relative net worth was most strongly correlated with non-financial asset prices, followed by financial asset prices. The correlation with quantities for non-financial assets was also strong, but appears to be related to the collapse of the U.S. housing market, because the correlation is weakened when only data for 1973 to 2005 are examined. The weakest correlation was with changes in liability prices.

Table 3
Correlations between changes in Canada–United States relative net worth per capita and relative prices and relative quantities per capita, 1973 to 2012 and 1973 to 2005

	Non-financial assets	Financial assets	Liabilities
		correlations	
1973 to 2012			
Prices	0.53	0.44	-0.03
Quantities	0.42	-0.18	0.21
1973 to 2005			
Prices	0.41	0.42	-0.18
Quantities	0.10	-0.10	0.24

Note: Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; Bureau of Economic Analysis, National Income and Product Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

The relative value of housing is important in explaining differences in net worth in the two countries. This is illustrated in Chart 1, which shows similar movements in the ratio of Canadian to U.S. net worth per capita and the ratio of Canadian to U.S. real estate values per capita over the 1970-to-2012 period. During these four decades, relative net worth and relative real estate values had a correlation of 0.85.

3.3 Real net worth per capita growth, 1970 to 2012

Using a PPP to convert net worth into a common currency masks the growth of net worth in the individual countries. An alternative is to use measures specific to each nation, which illustrate how their net worth evolved.

Net worth per capita is a measure of the average wealth of households in a particular year. Assets such as housing, stocks and bonds can retain value from one period to the next. These assets allow households to smooth consumption across time (Dusansky and Koc 2007; Diaz and Luengo-Prado 2008; Ortalo-Magne and Rady 2006; Hu 2004; Flavin and Yamashita 2002;

9. Housing prices reflect interest rates, and as a result, the price used for non-financial assets is not independent of the price used for liabilities.
10. Federal Reserve data on 30-year mortgage rates are available from 1972.
11. Because the mortgage markets in Canada and the United States differ substantially, it is not possible to exactly match the duration and structure of mortgages when making an international comparison (Green and Wachter 2005).

Brown, Hou and Lafrance 2010; Brown and Lafrance 2010). The growth of net worth per capita relative to inflation indicates how well households were able to select, acquire and hold assets that facilitate consumption-smoothing.[12]

To examine net worth over time for each nation, the PPP-adjusted ratio is deconstructed into its numerator (Canada) and denominator (United States), each of which is treated as a separate series. From (4), the real net worth metrics are:

$$y^i_t = \frac{\frac{P^{NW}_{i,t}}{P^{PCE}_{i,t}} Q_{i,t}}{Pop_{i,t}} \quad i = Can, US. \tag{6}$$

Deflated net worth per capita rose in both countries, but more rapidly in Canada: 3.2% a year versus 2.2% a year in the United States (Chart 3, Table 4). The difference is largely attributable to the 1973 oil shock and collapse of the U.S. housing market in 2007. Between 1974 and 2006, annual growth rates were much closer: 3.1% in Canada and 3.2% in the United States.

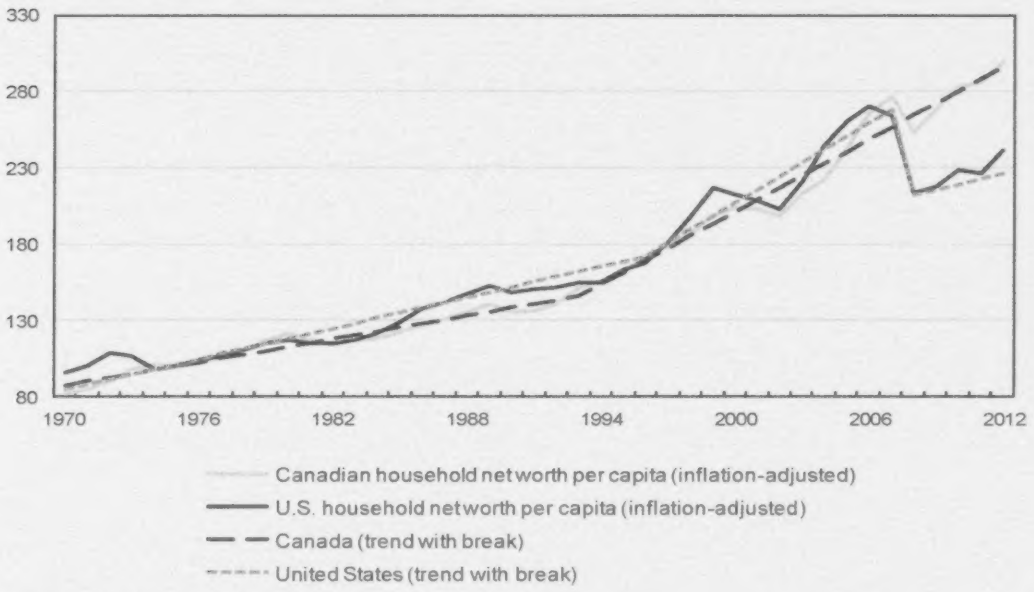
Early in the period, net worth per capita fell in the United States and rose in Canada. The U.S. decline coincided with the 1973 oil shock, which reduced asset values and caused a recession. Although Canada also had a recession following the oil shock (Cross 1996), it was less severe.

In the first half of the 1980s, Canada's net worth per capita growth slowed more than did that of the United States. In part, this reflects a slower recovery of Canadian financial asset prices, as interest rates in the two countries followed broadly similar paths. U.S equities, however, increased in value more rapidly. Between January 1980 and December 1985, the Dow Industrial Index rose 77%, compared with a 43% increase in the TSE Index. In the mid-1990s, Canadian and U.S. net worth per capita growth accelerated, and cyclical changes became more pronounced.

With the collapse of the U.S. housing market, net worth per capita growth slowed in the United States, but began to rise in Canada. After 2007, the growth rate in the United States was more like that of the 1970s and 1980s than the late 1990s and early 2000s.

12. Construction of the price index of consumer expenditure in Canada and the United States followed the guidelines from the System of National Accounts 2008. However, because of structural differences in the two economies, there are some differences, notably, the treatment of health care expenditures.

Chart 3
Inflation-adjusted household net worth per capita, Canada and the United States, 1970 to 2012



Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

Table 4
Annual growth rate of inflation-adjusted household net worth per capita, Canada and the United States, selected periods, 1970 to 2012

	1970 to 2012	1990 to 2012	1970 to 1975	1975 to 1980	1980 to 1985	1985 to 1990	1990 to 1995	1995 to 2000	2000 to 2005	2005 to 2012
					percent					
Canada	3.2	3.7	4.3	3.9	0.1	2.2	3.5	4.8	3.6	3.0
United States	2.2	2.3	1.0	3.1	1.9	2.9	1.9	5.5	4.2	-1.1

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

Two main findings emerge from the comparison of inflation-adjusted net worth per capita: the growth rate appeared to change in the 1990s, and became more volatile in the mid-1990s, particularly in the United States.

The exact timing of changes in growth trends is, however, difficult to identify. The selection of endpoints can affect how large or small a trend might be, and the particular year when a change occurs. Additionally, the dot.com bubble and the housing bubble in the United States complicate analysis because they create heteroscedastic regression residuals.

Here, three approaches are used to test for the presence of a trend break. First, Andrews-Quandt tests for an unknown breakpoint are performed. A null hypothesis that there was no break is tested against an alternative hypothesis that there was a break. The test calculates Chow breakpoints for all dates between the start and end of the sample after trimming, and

aggregates the information in different ways. The maximum Chow Likelihood ratio F-tests are reported with the P-values calculated by Hansen (1997) and reported in the Eviews software package.

Second, an iterative procedure based on t-tests is employed. A spline regression is used to test for a change in trend for each year between 1980 and 2001, with the maximum t-scores used to select the most likely breakpoint. These dates were chosen because they are in the middle of the sample, and therefore, cover the portion of the sample where the most reliable inference about trend change can be made. For each hypothesized trend change date, the standard t-test, t-tests using White's heteroscedasticity-corrected standard errors, and t-tests based on the more general Newey-West heteroscedasticity autocorrelation (HAC) covariance estimator are reported.

Third, an iterative grid search is performed across various lag lengths using the regression:

$$y^{i}_{t} = \alpha + \beta trend + \delta trend^{*} + e_{t} \; ; \; i = Can, \; US, \tag{7}$$

where $trend^{*}$ is defined as $trend^{*} = trend - year \; \forall year = 1982 \ldots 2012$ and zero otherwise. $trend^{*}$ is allowed to take lengths of 5 to 20 years. For example, for the whole sample, which ends in 2012, the algorithm estimates equation (7) allowing for a trend change between 2007 and 2012, 2006 and 2012, 2005 and 2012, and so on until it breaks the sample roughly in half and allows for a different trend from 1982 to 2012. The log-likelihood value from the maximum likelihood estimator assuming a normal distribution is recorded, and the combination of $trend^{*}$ length and period that produces the highest likelihood value is selected.

The results are presented in Table 5, and the fitted values from the preferred regressions are plotted on Chart 3. The Andrew-Quandt tests suggest a trend change in 1997 or in 2008 for the United States, and in 2004 or 2005 for Canada. The dates implied by the Andrews-Quandt tests are sensitive to the degree to which the sample is trimmed, and cluster around points associated with the onset or collapse of asset bubbles in the United States.

The t-tests suggest trend changes in the middle of the 1990s in the United States, and at the beginning of the 1990s in Canada. However, the results differ across standard error calculations. For the United States, the standard t-tests suggest a break one year earlier than do t-tests based on robust standard errors; for Canada, the HAC-corrected t-test suggests a break one year later.

Table 5
Results of tests for breaks in growth trend of inflation-adjusted household net worth per capita, Canada and the United States

Tests performed, country (implied break years)	Test results	
	results	p-value
Andrews-Quandt Likelihood ratio test		
5% trim, United States (1997)	21.84	0.00
5% trim, Canada (2005)	91.74	0.00
10% trim, United States (1997)	21.84	0.00
10% trim, Canada (2004, 2005)	91.74	0.00
15% trim, United States (1997)	21.84	0.00
15% trim, Canada (2005)	91.74	0.00
Max t statistic		
Unadjusted, United States (1995)	9.09	0.00
Unadjusted, Canada (1992)	10.92	0.00
White robust standard errors, United States (1995)	10.87	0.00
White robust standard errors, Canada (2002)	10.34	0.00
HAC corrected, United States (1995)	10.07	0.00
HAC corrected, Canada (1993)	7.52	0.00
Iterative algorithm		
Log likelihood, United States (1997, 2007)	-153.74	...
Log likelihood, Canada (1994)	-142.17	...

... not applicable

Notes: HAC stands for heteroscedasticity autocorrelation. Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

The iterative algorithm suggests a different trend for U.S. real net worth per capita growth between 1997 and 2007 (Table 6), which is consistent with the inference from the Andrews-Quandt breakpoint tests that a change occurred around those points. Before 1997 and after 2007, the trend in the rate of increase for the United States was similar. For Canada, the results from the iterative search suggest a trend change in 1994 that persisted until the end of the period.

The tests for trend change do not conclusively identify the year when a change occurred, but they consistently indicate that a change did occur.[13] For the United States, the possibility that the effects of the dot.com bubble and housing bubble were temporary is reflected in the results from the Andrews-Quandt and log-likelihood approaches. For Canada, the trend change appears more permanent. The t-test and log-likelihood approaches both point to the change occurring first in Canada.

13. Although the results are not conclusive about the exact date of the break, the use of three different approaches versus a single approach provides more robust evidence that a change occurred.

Table 6
Maximized log-likelihood equations, household net worth per capita, Canada and the United States, selected periods

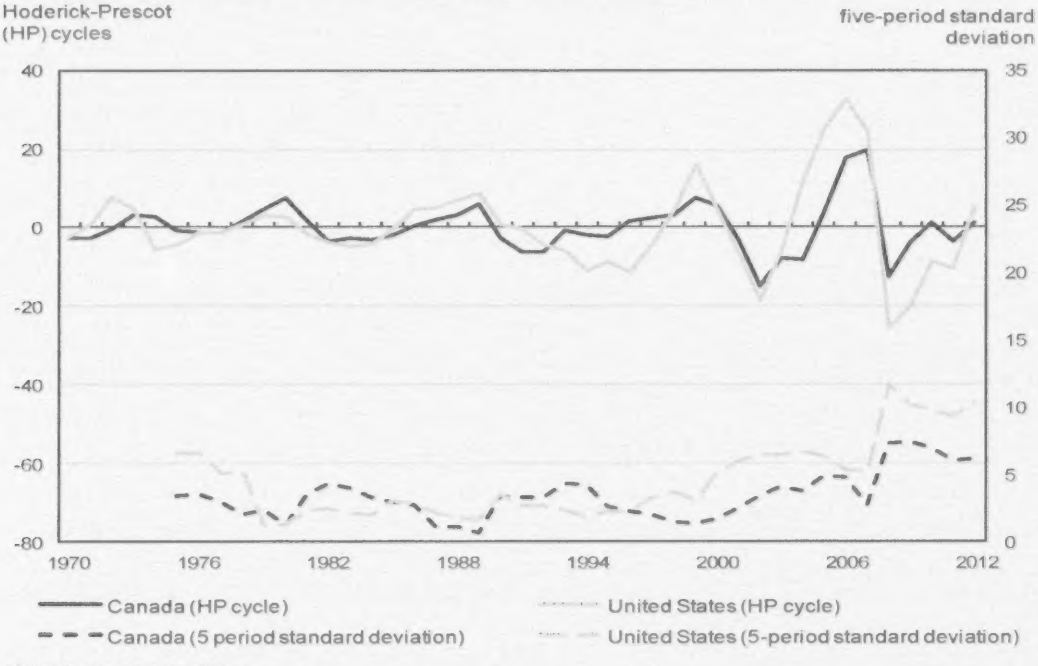
	Canada	United States
	value	
Constant	87.16	84.26
P-value	0.00	0.00
Trend	2.54	3.38
P-value	0.00	0.00
Trend change 1994 to 2011	5.38	...
P-value	0.00	...
Trend change 1996 to 2007	...	5.37
P-value	...	0.00
	ratio	
Log likelihood	-142.17	-153.74

... not applicable

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

Chart 4
Cyclical variation in inflation-adjusted household net worth per capita, Canada and the United States, 1970 to 2012



Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

The 1990s also saw greater cyclical variation in real net worth per capita. Chart 4 plots the five-period moving average of the annual growth rates of real net worth per capita in Canada and the United States, as well as the cycle around the Hoderick-Prescot filtered trends for each series. From the late-1970s to the mid-1990s, the variance estimates are similar for the two nations. In the early 1970s, the oil shock, and its larger effect on the American economy, raised its variance estimate. In the late 1990s, the variance estimates became larger, particularly in the United States, where the dot.com and housing bubbles occurred. The five-period moving average for the variance peaked in 2008 for the United States, and in 2009 for Canada.

The pattern is similar in the Hoderick-Prescot cycles. In the early 1970s, the cyclical movement differed in Canada and the United States. From the late 1970s to the mid-1990s, the cycles in the two countries were positively correlated, with similar timing and amplitude. After the mid-1990s, the amplitude of the cycles increased, especially in the United States.

3.4 Net worth relative to household disposable income per capita, 1970 to 2012

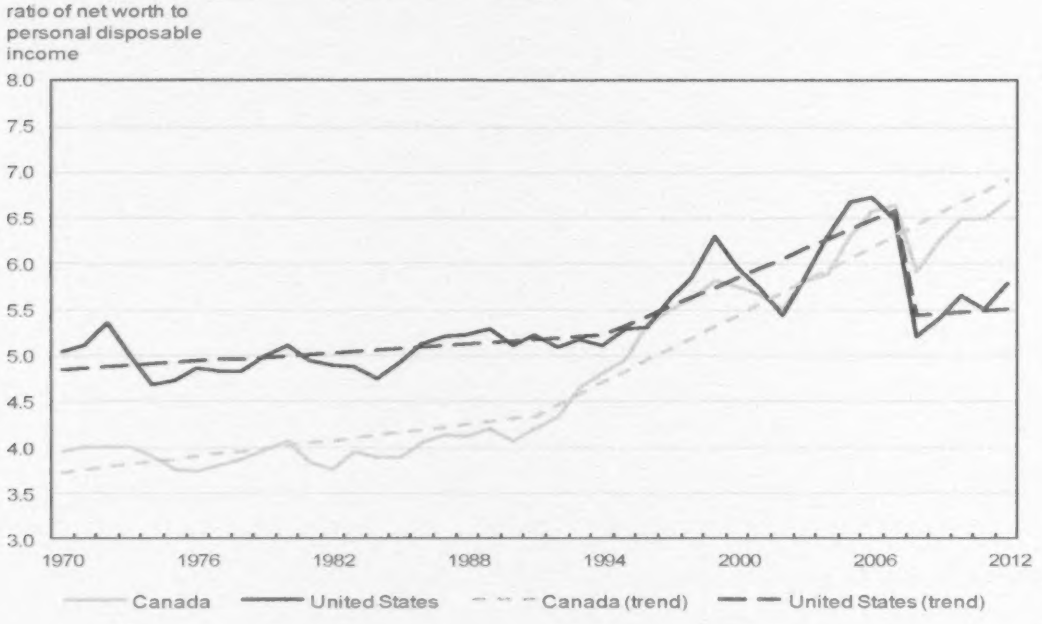
To this point, prices of consumer expenditures have been used to adjust net worth values for inflation. This section examines the ratio of household net worth to disposable income. Estimates of disposable income for the United States are from the Bureau of Economic Analysis; data for Canada come from the CSNA.[14] The resulting ratio is:

$$v_t^i = \frac{P_{i,t}^{NW} Q_{i,t}}{Yd_{i,t}} \quad i = Can, US. \tag{8}$$

For Canada, the ratio of per capita household net worth to disposable income shows a structural break similar to that indicated by inflation-adjusted net worth per capita. For the United States, the trend change is less obvious, and the effects of the dot.com and housing bubbles are more pronounced (Chart 5). Between 1970 and 2012, Canada's household-net-worth-to-disposable-income ratio rose from 4.0 to 6.7. The U.S. ratio rose from 5.0 in 1970 to 6.5 in 2007 and then declined to 5.8 in 2012.

14. Differences in disposable income in the two countries remain largely because of how their health care systems are funded. Canadian disposable income takes into account expenditures on health care, which are funded through taxes; U.S. households have to fund similar health care expenditures out of their income.

Chart 5
Ratio of per capita household net worth to disposable income, Canada and the United States, 1970 to 2012



Note: Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

Canada's ratio rose modestly but remained near an average of 4.0 for most of the 1970s and 1980s. After the 1991 recession, the pace at which the ratio was rising accelerated, and despite some cyclical variability, the increase continued to 2012.

The U.S. ratio also rose modestly, but averaged 5.0 from the 1970s to the mid-1990s and then began to rise, reflecting the dot.com bubble and the housing bubble. After the collapse of the housing market in 2007, the ratio returned to a level consistent with historical (1970 to 1996) values. After the collapse of the U.S. housing bubble, for the first time, the ratio of net worth to disposable income in Canada was above that in the United States.

These trends roughly match the behaviour of real net worth per capita. To support conclusions about structural change, the three approaches that were used to examine real net worth per capita were replicated for the ratio of household net worth to disposable income. The results are reported in Table 7 and Table 8, and the fitted values from the preferred specification of the iterative grid search algorithm that maximizes the log-likelihood value are plotted on Chart 5.

The Andrews-Quandt tests for the United States are consistent with the results from the test on real net worth per capita, and with the period selected for a different trend using the iterative log-likelihood algorithm. The most likely breaks in the U.S. ratio are 1997 and 2008. For Canada, the results of the Andrews-Quandt test suggest a break in 1994, which accords with the results from the iterative algorithm for real net worth per capita. However, the results from the iterative algorithm on the ratio of net worth to disposable income suggest the trend change in Canada occurred in 1990.

Based on the t-tests, the breakpoints are moved back by one or two years for the United States, and two to four years for Canada. This may be attributable to the effects of the 1991 recession, affecting the ability of the tests to determine breakpoints. Nevertheless, across all tests, the structural change appears first in Canada.

The ratio of household net worth to disposable income also exhibits the acceleration in cyclical amplitude and rising variance illustrated using real net worth per capita (Chart 6).

Table 7
Results of tests for breaks in trend of ratio of per capita household net worth to disposable income, Canada and the United States

Tests performed, country (implied break years)	Test results	
	results	p-value
Andrews-Quandt Likelihood ratio test		
5% trim, United States (2008)	14.45	0.00
5% trim, Canada (1995)	90.69	0.00
10% trim, United States (1997)	9.53	0.04
10% trim, Canada (1995)	90.69	0.00
15% trim, United States (1997)	9.53	0.03
15% trim, Canada (1995)	90.69	0.00
Max t statistic		
Unadjusted, United States (1994)	5.00	0.00
Unadjusted, Canada (1989)	8.69	0.00
White robust standard errors, United States (1994)	6.42	0.00
White robust standard errors, Canada (1990)	12.76	0.00
HAC corrected, United States (1994)	5.79	0.00
HAC corrected, Canada (1989)	9.40	0.00
Iterative algorithm		
Log likelihood, United States (1995)	5.24	...
Log likelihood, Canada (1992)	0.10	...

... not applicable

Notes: HAC stands for heteroscedasticity autocorrelation. Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; and U.S. Federal Reserve, Flow of Funds Accounts.

Table 8
Maximized log-likelihood equation, ratio of per capita household net worth to disposable income, Canada and the United States, selected periods

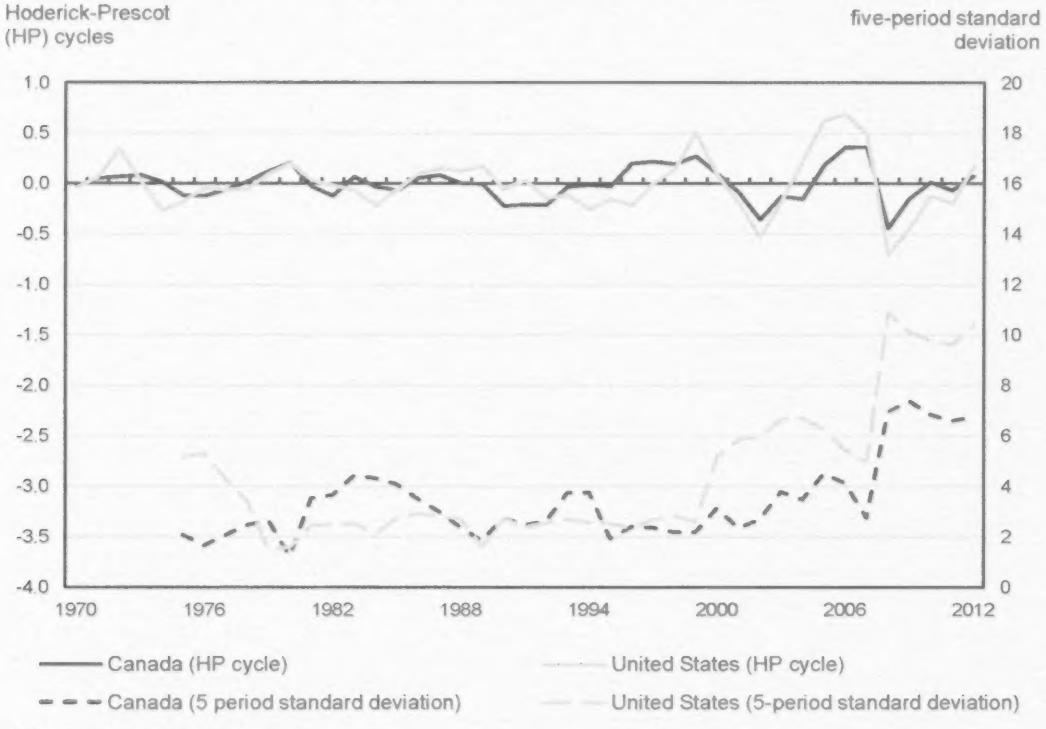
	Canada	United States
	value	
Constant	3.73	4.84
P-value	0.10	0.07
Trend	0.03	0.02
P-value	0.01	0.00
Trend change, 1990 to 2012	0.09	...
P-value	0.01	...
Trend change, 1996 to 2007	...	0.09
P-value	...	0.01
	ratio	
Log likelihood	0.10	5.24

... not applicable

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

Chart 6
Cyclical variation in ratio of per capita household net worth to disposable income, Canada and the United States, 1970 to 2012



Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

4 Decomposing net worth growth

The examination of real net worth per capita and net worth relative to disposable income provide evidence that the trend in the growth rate of household net worth changed in the 1990s, and that the change appears to be more permanent in Canada than in the United States. In this section, sources of the change are investigated using a decomposition analysis.

The growth of net worth over time can be decomposed using either real net worth or the ratio of net worth to disposable income. The ratio of net worth to disposable income was chosen because this decomposition includes a term that captures the debt-to-income ratio. [15]

The ratio of net worth to disposable income is decomposed into: non-financial assets relative to disposable income, financial assets relative to disposable income, and liabilities relative to disposable income:

$$v_t^i = \frac{P_{i,t}^{NW} Q_{i,t}}{Yd_{i,t}} = \frac{NFA_{i,t}}{Yd_{i,t}} + \frac{FA_{i,t}}{Yd_{i,t}} - \frac{LIA_{i,t}}{Yd_{i,t}} \quad i = Can, US. \tag{9}$$

These ratios are reported in Table 9 for selected years. Each ratio increased over time: Canadian and U.S. households generally had more assets and more liabilities relative to disposable income in 2012 than in 1970. The exception was non-financial assets in the United States, where housing prices had not recovered after the housing market collapse in 2007.

The period after 2007 was the first time that all ratios decreased in the United States. After the housing market collapse, asset values fell, and savings rates increased to pay down debt.

By contrast, in Canada, after a pause, all ratios began rising again. In 2012, asset-to-income and liability-to-income ratios were the highest on record. Moreover, because liabilities were offset by increases in assets, net worth rose.

Growth rates for the components of decomposed net worth (Table 10) reinforce the trends illustrated by the ratios (Table 9). In particular, the dot.com bubble and housing bubble coincided with increases in assets and liabilities, which suggests that households were investing with the liabilities they incurred. This was the case for housing, which typically involves acquiring a mortgage.

15. Debt-to-income ratios are a method for assessing debt burdens, but as a stock-to-flow ratio, they are problematic. What matters for household finances is the carrying cost on the debt (Faruqui 2008), and what matters for household balance sheets is the reason the debt was incurred and the growth of the value of household assets. Because National Accounts data are aggregated, they are ill-suited to addressing questions about individual household budgets. In per capita terms, National Accounts data provide a value for an average across all individuals, regardless of family structure. It is not possible to identify, for example, marginal individuals or families for whom a change in debt-servicing charges would create unsustainable payments. Micro-economic research shows that debt-service ratios in Canada did not increase in line with debt levels (Faruqui 2008).

Table 9
Decomposed ratio of per capita household net worth to disposable income, Canada and the United States, selected years, 1970 to 2012

	1970	1975	1980	1985	1990	1995	2000	2005	2012
					ratio				
Canada									
Non-financial assets relative to disposable income	2.67	2.59	2.67	2.28	2.46	2.71	2.80	3.40	3.84
Financial assets relative to disposable income	1.87	1.78	2.11	2.26	2.52	3.24	4.06	4.24	4.50
Liabilities relative to disposable income	0.59	0.60	0.72	0.66	0.91	0.99	1.10	1.32	1.65
United States									
Non-financial assets relative to disposable income	2.84	3.02	3.53	3.27	3.22	2.88	3.15	4.13	2.87
Financial assets relative to disposable income	3.05	2.63	2.62	2.80	3.08	3.59	4.17	4.29	4.51
Liabilities relative to disposable income	0.85	0.92	1.05	1.14	1.19	1.19	1.37	1.74	1.59

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

Table 10
Growth rates of decomposed ratio of per capita household net worth to disposable income, Canada and the United States, selected periods, 1970 to 2012

	1970 to 1980	1980 to 1990	1990 to 2000	2000 to 2012	1970 to 1990	1993 to 2001	2002 to 2007	2007 to 2012
					percent			
Canada								
Non-financial assets relative to disposable income	0.01	-0.82	1.30	2.67	-0.40	1.25	3.92	1.04
Financial assets relative to disposable income	1.23	1.78	4.87	0.88	1.50	3.40	4.08	0.31
Liabilities relative to disposable income	2.05	2.36	1.96	3.41	2.21	2.06	4.63	2.81
United States								
Non-financial assets relative to disposable income	2.21	-0.92	-0.21	-0.76	0.63	1.19	2.13	-5.05
Financial assets relative to disposable income	-1.51	1.63	3.06	0.66	0.05	1.80	5.30	-0.53
Liabilities relative to disposable income	2.16	1.29	1.40	1.22	1.73	2.56	4.91	-3.34

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

The ratios and their component growth rates show that financial assets played a dominant role in annual changes in net worth growth. To quantify the importance of financial assets, changes in equation (9) are decomposed into three elements:

$$d\ln\left(v^{i}_{t}\right)=\varpi_{NFA}\times d\ln\left(\frac{NFA_{i,t}}{Yd_{i,t}}\right)+\varpi_{FA}\times d\ln\left(\frac{FA_{i,t}}{Yd_{i,t}}\right)-\varpi_{LIA}\times d\ln\left(\frac{LIA_{i,t}}{Yd_{i,t}}\right)\quad i=Can,US. \tag{10}$$

Where:

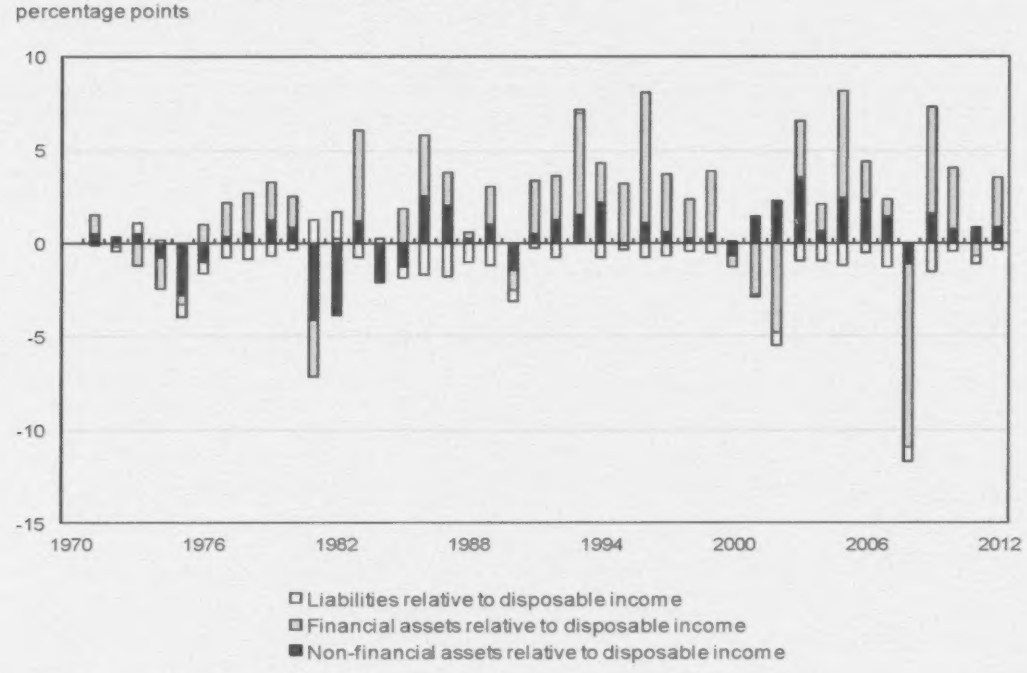
$$\varpi_{t}=0.5\times\left(\frac{X_{i,t}}{NW_{i,t}}+\frac{X_{i,t-1}}{NW_{i,t-1}}\right),i=NFA,FA,LIA.$$

Table 11
Average absolute contribution of sources of per capita household net worth relative to disposable income, Canada and the United States, selected periods, 1971 to 2012

	1971 to 2012	1971 to 1990	1991 to 2012	1991 to 2012 excluding 2008
			ratio	
Canada				
Non-financial assets relative to disposable income	1.35	1.44	1.28	1.29
Financial assets relative to disposable income	2.55	1.59	3.42	3.11
Liabilities relative to disposable income	0.68	0.76	0.61	0.60
United States				
Non-financial assets relative to disposable income	1.94	1.44	2.40	2.04
Financial assets relative to disposable income	3.32	2.32	4.24	3.85
Liabilities relative to disposable income	0.67	0.50	0.82	0.82

Note: Authors' calculations.
Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

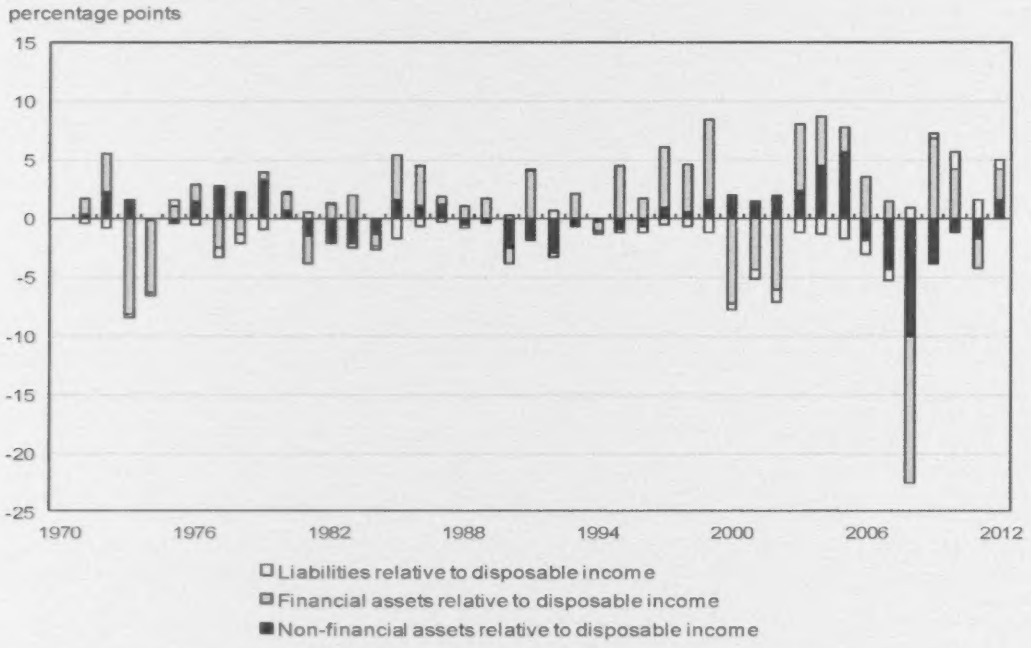
Chart 7
Sources of change in the ratio of per capita household net worth to disposable income, Canada, 1970 to 2012



Note: Authors' calculations.
Source: Statistics Canada, Canadian National Balance Sheet Accounts.

For both nations, changes in financial assets relative to disposable income were the primary source of fluctuations in the growth of net worth (Chart 7, Chart 8). After 1990, the absolute value of changes in financial assets relative to income was more than twice as large as contributions from non-financial assets, and many times the effects of liability ratio changes (Table 11). This holds even when the unusually large decline in net worth in 2008 is removed from the sample.

Chart 8
Sources of change in ratio of per capita household net worth to disposable income, the United States, 1970 to 2012



Note: Authors' calculations.

Sources: U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

Table 12
Correlation between sources of change in per capita household net worth relative to disposable income, Canada and the United States, 1970 to 2012

	Contributions	Absolute contributions
	correlation	
Non-financial assets relative to disposable income	0.27	0.05
Financial assets relative to disposable income	0.78	0.47
Liabilities relative to disposable income	0.23	0.02

Note: Authors' calculations.

Sources: Statistics Canada, Canadian National Balance Sheet Accounts; U.S. Federal Reserve, Flow of Funds Accounts; and Bureau of Economic Analysis, National Income and Products Accounts.

The importance of financial assets in annual changes in net worth contrasts with the importance of non-financial asset prices for Canadian net worth relative to U.S. net worth adjusted for purchasing power parity. This apparent anomaly can be reconciled if the values of financial assets relative to income between Canada and the United States are correlated, but the values of non-financial assets relative to income are not. The correlation between Canadian and U.S. contributions to changes in net worth relative to disposable income from financial assets was 0.78 (Table 12). For non-financial assets and liabilities, the correlations were 0.27 and 0.23, respectively. The correlation between absolute changes of financial asset contributions was 0.47,—about half the time, Canada and the United States experienced above-average or below-average changes simultaneously. For non-financial asset and liability contributions, the correlation was near zero. In effect, financial asset contributions to net worth changes are

correlated, while contributions from housing and debt are only weakly related between Canada and the United States.

5 Conclusion

International comparisons of the growth of net worth are challenging: data are not estimated in the same way; terminology may not refer to the same units; and the optimal choice of a type of currency conversion rate is not clear. To overcome some of the inherent difficulties and produce a more robust set of findings, this analysis used three approaches to examine the relative growth of Canadian and U.S. net worth per capita from 1970 to 2012.

The first approach, which uses purchasing power parities, illustrates three features of net worth per capita growth in North America: growth in Canada and the United States was generally similar over the period; net worth per capita in Canada relative to the United States rose rapidly when the U.S. housing market collapsed; and changes in Canada relative to the United States often reflect differences in housing value trends.

The second approach, which uses real net worth per capita and the ratio of net worth to income, shows a change in the process underlying net worth growth. The growth rate accelerated in the 1990s in both countries, but first in Canada, where it seems to be more permanent. The amplitude of the cycles of net worth per capita widened after 1990, particularly in the United States.

The third approach decomposes annual changes in net worth relative to disposable income into contributions from non-financial assets, financial assets and liabilities. It shows that contributions from financial asset prices are the major source of fluctuations in net worth-to-disposable income ratios in both countries, and that contributions from financial assets are correlated across Canada and the United States. In neither Canada nor the United States were changes in liabilities a significant source of year-to-year fluctuations in net worth.

6 Appendix

6.1 Linking Canadian net worth data

Creation of an analytical dataset for Canadian household net worth requires linking two vintages of data: the "historical vintage" and the "current vintage." The current vintage incorporates new data sources, and contains concepts and methodologies that differ from previous vintages.

Two approaches were applied to create the analytical dataset. First, the level of household net worth in the current vintage was back-cast at an aggregate level based on the growth rates in the historical vintage. This approach was employed because the historical vintage and the current vintage had almost identical growth patterns between 1990 and 2001 but that a relationship becomes weaker after 2001. The implication being that changes in methodology and the incorporation of new data sources had a greater effect on more recent estimates.

Second, net worth subcomponents were back-cast using a multi-part process. The subcomponents of non-financial assets, financial assets and financial liabilities from the current vintage were re-aggregated to match, as closely as possible, the categories in the historical vintage. In most cases, an appropriate match could be made. The growth rates for each component from the historical vintage and the current vintage were calculated, and a regression was used to map historical vintage growth rates onto the modern vintage growth rates using data from 1991 to 2001:

$$\dot{y}_{i,t}^{Current} = \alpha + \beta \dot{y}_{i,t}^{Historical} + \varepsilon_{i,t} \; i = components.$$

The parameter estimates from the regressions were then used to predict the historical growth rates of the individual components. The predicted growth rates were used to back-cast the level of the current vintage components from 1989 to 1970.

The final step integrated the back-casting for household net worth and the subcomponents. When the individual subcomponents are aggregated, the growth rate of net worth from the predicted values understates net worth growth from the historical vintage by an average of 3.6 percentage points from 1971 to 1989.

To integrate the aggregate and disaggregate estimates, the share of each disaggregate component in the predicted net worth value was calculated. The shares were then applied to the aggregate back-cast value for household net worth. The resulting disaggregate series, which sum to household net worth estimate based on the aggregate back-casting, were employed in this study.

References

Antoniewicz, R., R. Bonci, A. Generale, G. Marchese, A. Neri, K. Maser, and P. O'Hagan. *Household wealth : comparing micro and macro data in Canada, Italy and the United States*. Paper presented at the conference "Construction and Usage of Comparable Micro Data on Wealth," Luxembourg Wealth Study, Perugia, Italy, January 2005.

Baldwin, J.R., D. Leung, and R. Rispoli. 2011. *Labour Productivity of Unincorporated Sole Proprietorships and Partnerships: Impact on the Canada-U.S. Productivity Gap*. Economic Analysis Research Paper Series, no. 71. Statistics Canada Catalogue no. 11F0027M. Ottawa: Statistics Canada.

Baldwin, J.R., and R. Macdonald. 2009. *PPPs: Purchasing Power or Producing Power Parities?* Economic Analysis Research Paper Series, no. 58. Statistics Canada Catalogue no. 11F0027M. Ottawa: Statistics Canada.

Bailliu, J., K. Kartashovak, and C.Meh. 2012. "Household borrowing and spending in Canada." *Bank of Canada Review*, Winter 2011-2012. p.16–29.

Brown, M., and A. Lafrance. 2010. *Incomes from Owner-occupied Housing for Working-age and Retirement-age Canadians,1969 to 2006*. Economic Analysis Research Paper Series, no. 66. Statistics Canada Catalogue no. 11F0027M. Ottawa: Statistics Canada.

Brown, M., F. Hou, and A. Lafrance. 2010. *Incomes of Retirement-age and Working-age Canadians: Accounting for Home Ownership*. Economic Analysis Research Paper Series, no. 64. Statistics Canada Catalogue no. 11F0027M. Ottawa: Statistics Canada.

Cooper, S., and S. Gautieri. 2012. *Will Canada's Housing Boom Forge On, Fizzle Out, or Flame Out?* BMO Capital Markets Special Report. Toronto: Bank of Montreal.

Credit Suisse Research Institute. 2012. *Global Wealth Report 2012*. Zurich: Credit Suisse Research Institute.

Cross, P. 1996. "Alternative measures of business cycles in Canada." *Canadian Economic Observer* 8 (2): 3.1–3.40. Statistics Canada Catalogue no. 11-010-X.

Diaz, A., and M. Luengo-Prado. 2008. "On the user cost and homeownership." *Review of Economic Dynamics* 11 (3): 584–613.

Dyan, K. 2012. *Is a Household Debt Overhang Holding Back Consumption*? Washington, D.C.: Brookings Institution.

Dusansky, R., and K. Koc. 2007. "Capital gains effect in the demand for housing." *Journal of Urban Economics* 61 (2): 287–298.

Faruqui, U. 2008. *Indebtedness and household financial health: An examination of the Canadian debt-service ratio distribution*. Bank of Canada Working Paper, no. 2008-46. Ottawa: Bank of Canada.

Fitoussi, J.P., A. Sen, and J. Stiglitz. 2009. *Report by the Commission on the Measurement of Economic Performance and Social Progress*. Technical Report. Available at: http://www.stiglitz-sen-fitoussi.fr/documents/rapport_anglais.pdf.

Flavin, M., and T. Yamashita. 2002. "Owner-occupied housing and the composition of the household portfolio." *The American Economic Review* 92 (1): 345–362.

Furceri, D., and A. Zdzienicka. 2012. "How costly are debt crises?" *Journal of International Money and Finance* 31 (4): 726–742.

Glick, R., and K. Lansing. 2009. *U.S. Household Deleveraging and Future Consumption Growth.* FRSBF Economic Letter, no. 2009-16. San Francisco: Federal Reserve Bank of San Francisco.

Green, R.K., and S.M. Wachter. 2005. "The American mortgage market in historical and international context." *Journal of Economic Perspectives* 19 (4): 93–114.

Hansen, B. 1997. "Approximate asymptotic p-values for structural change tests." *Journal of Business and Economic Statistics* 15 (1): 60–67.

Horner, K. 2009. *Retirement Saving by Canadian Households.* Prepared for The Research Working Group on Retirement Income Adequacy. Ottawa: Department of Finance.

Hu, X. 2004. "Portfolio choices for homeowners." *Journal of Urban Economics* 58 (1): 114–136.

Mian, A., and A. Sufi. 2009. *Household Leverage and the Recession of 2007 to 2009.* Paper presented at the 10th Jacques Polak Annual Research Conference. Washington, DC: International Monetary Fund.

Modigliani, F., and R. Brumberg. 1954. "Utility Analysis and the Consumption Function, and Interpretation of Cross Section data." In *Post-Keynsian Economics*, ed. K Kurihara. New Jersey: Rutgers University Press. Reprinted in 2005 in *The Collected Papers of Franco Modigliani.* Cambridge, Massachusetts: The MIT Press.

Organisation for Economic Co-operation and Development (OECD). *Review of the OECD-Eurostat PPP Program.* No. STD/PPP(97)5. Available at: http://www.oecd.org/std/prices-ppp/2405262.pdf

Ortalo-Magne F., and S. Rady. 2006. "Housing market dynamics: on the contribution of income shocks and credit constraints." *The Review of Economic Studies* 73 (2): 459–585.

Samuelson, P. 1958. "An exact consumption-loan model of interest with or without the social the contrivance of money." *Journal of Political Economy* 66 (6): 467-482.

Tang, G., and C. Upper. 2010. "Debt reductions after crises." *BIS Quarterly Review* September 2010: 25–38.

United Nations, European Commission, International Monetary Fund, Organisation for Economic Co-operation and Development, and World Bank, 2010. *System of National Accounts, 2008.* New York: United Nations Department of Economic and Social Affairs.